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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/008,665	11/03/2001	Eric R. Alling	50781	7668

7590 10/23/2003

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EXAMINER

MUTSCHLER, BRIAN L

ART UNIT PAPER NUMBER

1753

DATE MAILED: 10/23/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/008,665

Applicant(s)

ALLING ET AL.

Examiner

Brian L. Mutschler

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 September 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10 and 21-31 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-10 and 21-31 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4.
- 4) ☐ Interview Summary (PTO-413) Paper No(s): _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

Comments

1. Applicant's cancellation of claims 11-20 in the response received September 26, 2003, is acknowledged.
2. The objection to the specification has been overcome by Applicant's amendment.
3. The objections to claims 8, 18, 21 and 30 have been overcome by Applicant's amendment of claims 8, 21 and 31 and the cancellation of claim 18.
4. The rejection of claims 1-31 under 35 U.S.C. § 112, 1st paragraph, has been overcome by Applicant's amendment to the claims, which clarifies that the copper and other metal layers are plated from the sources within the bath and not separate baths.
5. The rejection of claims 21, 27, 28, 30 and 31 are rejected under 35 U.S.C. 102(e) as being anticipated by Meltzer et al. has been withdrawn in light of Applicant's amendment. Meltzer et al. do not disclose the substrates recited in the amended claims.
6. The rejection of claims 21, 25-27, 29 and 31 are rejected under 35 U.S.C. 102(b) as being anticipated by Cohen (U.S. Pat. No. 4,923,574). Cohen does not disclose the substrates recited in the amended claims.

Claim Rejections - 35 USC § 112

7. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

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8. Claims 21-31 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 21 recites the limitation "electrolytically depositing a layer of the first metal, from the second metal source, on the substrate at a first reduction potential; electrolytically depositing a second metal layer on the substrate, from the second metal source, at a second reduction potential distinct from the first reduction potential" in lines 8-11. This limitation is indefinite because it is unclear how both metal layers are deposited from the second metal source at two different potentials. It appears that the phrase "second metal source" in line 8 should be changed to --first metal source--. The same applies to dependent claims 22-31.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claims 1-10 and 21-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Meltzer et al. (U.S. Pat. No. 6,547,946) in view of Akram et al. (U.S. Pat. No. 5,893,966), with evidence of physical properties provided by CRC Handbook of Chemistry and Physics ("Thermal and Physical Properties of Pure Metals", 3rd Electronic Edition).

Regarding claims 1 and 21, Meltzer et al. disclose a method for depositing multiple metal layers on a printed wiring board by single bath deposition, wherein a copper layer and a nickel layer are plated from a single bath containing a copper metal source and a nickel metal source (fig. 1; col. 5, lines 8-52). Copper is plated using a low reduction potential and nickel is plated using a high reduction potential (fig. 3; col. 5, lines 8-28).

Regarding claim 2, the copper layer is formed as a homogenous layer (col. 5, lines 29-31).

Regarding claims 3-5 and 27, Meltzer et al. disclose that the nickel layer "contains a percentage of copper", which means the nickel layer is actually an alloy of nickel and copper (col. 5, lines 35-37).

Regarding claims 6 and 28, the reduction potentials used in the process of Meltzer et al. differ by at least 0.2 V (fig. 3).

Regarding claims 7 and 29, Meltzer et al. disclose that the method for fabricating the layered printed wiring board was "adapted from layered electroforming techniques used to build up copper-nickel composite materials of high tensile strength [and t]hese materials typically had many alternating, very thin layers of each metal" (col. 5, lines 55-59).

Regarding claims 8, 9 and 30, as seen in the table "Thermal and Physical Properties of Pure Metals", in the CRC Handbook of Chemistry and Physics, the resistivity of nickel is over 400% greater than the resistivity of copper. Therefore, any

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alloy comprising nickel with a percentage of copper would be expected to have a conductivity substantially less than that of copper.

Regarding claims 25 and 26, one or both of the metal layers can be alloyed with tin (col. 7, lines 56-67). Metal alloys, such as nickel-tin and copper-tin alloys, are homogenous materials.

Regarding claim 31, the metal layers are deposited from the same plating bath (col. 5, lines 29-52).

The method of Meltzer et al. differs from the instant invention because Meltzer et al. do not disclose the following:

- a. The substrate is a semiconductor substrate, as recited in claims 1, 21 and 22;
- b. A plurality of first metal layers are deposited with a plurality of alternating second metal layers, as recited in claims 7 and 29;
- c. The first metal layer functions as an electrical circuit and the second metal layer functions as an insulator layer, as recited in claim 9;
- d. The substrate is a lead or interconnect of a semiconductor device, as recited in claim 10;
- e. The substrate is a semiconductor package substrate, as recited in claim 23; and
- f. The substrate is a multi-chip module, chip capacitor, chip resistor, lead frame or an opto-electronic device, as recited in claim 24.

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Regarding claims 1 and 21-24, Akram et al. teach, "Semiconductor wafers, substrates and printed circuit boards (collectively hereinafter 'semiconductor substrates') are often coated with various metals" (col. 1, lines 16-20). Furthermore, Akram et al. teach, "Techniques for coating semiconductor substrates include electrodeposition...[and e]lectrodeposition has become a commonly used technology" (col. 1, lines 21-24).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the substrate used in the method of Meltzer et al. to use a semiconductor substrate because Akram et al. teach that semiconductor substrates are commonly coated using electrodeposition techniques and that semiconductors include semiconductor wafers, substrates and printed circuit boards. Regarding the different types of semiconductor substrates recited in claims 23 and 24, such semiconductors are common semiconductor types and it would have been obvious to one skilled in the art to form electrochemical deposits on such semiconductors because the methods and results are equivalent.

Regarding claims 7 and 29, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Meltzer et al. to plate a plurality of alternating layers because Meltzer et al. teach that the method is adapted from a method used to plate such a plurality of layers and that a material comprising such a plurality of layers has a high tensile strength.

Regarding claims 9 and 10, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have used the device fabricated by the method of Meltzer et al. to have the first metal layer function as an electrical circuit and the second metal layer function as an insulator layer or having the substrate (first metal layer?) function as a lead or interconnect because the structure of the device formed in the method of Meltzer et al. is identical to the structure of the device formed in the method recited in the instant claims, and therefore, the layers would be expected to function or be capable of functioning in a similar manner to the claimed function.

Response to Arguments

11. Applicant's arguments filed September 26, 2003, have been fully considered but they are not persuasive.

12. Regarding the rejections of claims 1-10 and 22-24 over Meltzer in view of Akram et al., Applicant has argued that the difference between plating circuit boards and semiconductors is significant and that "Persons skilled in the art recognize that plating copper and other metals on a semiconductor wafer or other semiconductor substrate is considerably more difficult, and poses unique issues relative to plating on a printed circuit board" (see page 8 of Applicant's response). As evidence, Applicant has cited U.S. Pat. Nos. 6,290,833; 6,297,154; and 6,171,960.

13. This argument is not persuasive. Regarding U.S. Pat. No. 6,290,833, following the statement cited by Applicant, US '833 states, "Electrochemical deposition of copper has been found to provide the most cost-effective manner in which to deposit a copper

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metallization layer...[and] such deposition techniques provide substantially conformal copper films that are mechanically and electrically suitable for interconnect structures" (col. 3, lines 7-9). Therefore, US '833 teaches that electrochemical deposition of copper is advantageous.

14. Regarding U.S. Pat. No. 6,297,154 and U.S. Pat. No. 6,171,960, the portions cited by Applicant have no relevance to the claims. The cited material of US '154 and US '960 is directed towards plating recesses and the properties of copper in general. There is no indication of how the cited portions relate to the instant invention of plating semiconductors.

15. As explained in the rejection of the instant claims, Meltzer teaches plating on printed circuit boards and Akram et al. teach that printed circuit boards, semiconductor wafers and substrates are all semiconductor substrates. Furthermore, Akram et al. teach that "electrodeposition has become a commonly used technology" (col. 1, line 24). In regard to Applicant's statements, what are the difficulties that had to be overcome by Applicant's that distinguish the instant claims over the prior art? Other than the substrates, there is no difference between the method of Meltzer and the instant application. This difference is obviated by the teachings of Akram et al., who demonstrate that printed circuit boards, semiconductor wafers and substrates are equivalent semiconductor substrates and that electrodeposition is equally carried out on each substrate. Applicant's own disclosure echoes this by reciting that the same method can be used to plate semiconductors, printed circuit boards and related

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substrates. Therefore, the instant claims are not distinguished over the prior art of record.

Conclusion

16. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

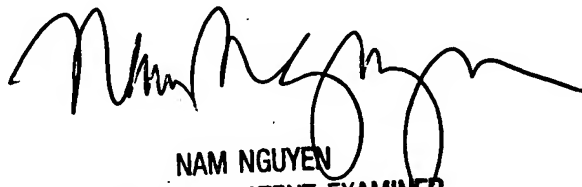
A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian L. Mutschler whose telephone number is (703) 305-0180. The examiner can normally be reached on Monday-Friday from 7:30am to 4:00pm. Once the Office moves to the new campus, the examiner can be reached at (703) 272-1341.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (703) 308-3322. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.



NAM NGUYEN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700

blm
October 17, 2003